Implantation Metastasis of Primary Malignant Rhabdoid Tumor of the Brain in an Adult (One Case Report)

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Primary malignant rhabdoid tumor (PMRT) of the brain is a rare and recently described neoplasm of youth. We report magnetic resonance imaging (MRI), computed tomography (CT), and pathology of one case of PMRT in an adult which seeded along the needle track for stereotactic biopsy. **Med. Pediatr. Oncol. 28:223–227**

Key words: brain; implantation; primary malignant rhabdoid tumor

INTRODUCTION

Primary malignant rhabdoid tumor (PMRT), described for the first time in 1978 in the kidney [1], has been rarely reported in other organs including the brain [2,3]. Eleven cases of PMRT of the brain have been reported in the literature. PMRT of the brain is a disease of youth; 90% of the reported cases were diagnosed in patients 18 years of age or less. The oldest patient at initial diagnosis of PMRT was 21 years of age [4]. Hanna et al. [5] reviewed the computed tomography (CT) and magnetic resonance imaging (MRI) findings of five cases of PMRT of the brain in childhood. We present a case of PMRT in an adult with its unusual image characteristics compared to the prior reports and its potential to seed along the needle track after stereotactic biopsy.

CASE REPORT

Clinical Findings

A 34-year-old man complained of 1 month of episodic tingling sensation of the right arm and impaired function of the right arm and leg. Neurological exam revealed slurred speech, difficulty with word finding and sentence construction, mild right central facial weakness with diminished pin sensitivity throughout the right face, and mild right hemiparesis involving the arm and leg to the same degree. There was slight hyperreflexia on the right side.

Imaging Findings

CT scan of the brain showed a 4 cm high attenuation lesion with negligible enhancement in the left cerebral hemisphere consistent with a hemorrhage (Fig. 1). An MRI revealed a 4 cm, well-defined left cerebral mass with short T_1 and T_2 relaxation time, minimal vasogenic edema, and peripheral enhancement (Fig. 2). No dilated vessels were present. CT scan of the chest, abdomen, and pelvis demonstrated no additional masses.

Pathology

CT-guided stereotactic needle biopsy from the brain mass was examined by light and electron microscopy. Light microscopy revealed neoplastic cells with plentiful cytoplasm and an eosinophilic inclusion which tended to displace the nucleus laterally. The nuclei exhibited open vesicular chromatin and a large nucleolus. Immunohistochemical staining showed immunoreactivity for vimentin only. Other immunohistochemical stains for hematopoietic, epithelial, muscular, and germ cell markers were nonreactive. Ultrastructurally, the numerous intermediate filaments which were arranged in bundles and whorls corresponded with the vimentin immunoreactivity noted by light microscopy (Fig. 3). Mitochondria were scanty and no neurosecretory granules or microtubules were identified. The cytoplasmic membranes exhibited poorly formed surface projections which did not possess junctions or cilia and did not fulfill the criteria for microvilli or interdigitating cell processes. Whorling bundles of vimentin intermediate filaments are the most common features of rhabdoid tumors [2].

The patient was treated with radiation therapy, receiving 56 cGy. He developed progressive weakness and a soft lesion on his skull at the prior biopsy site within

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Received 16 October 1995; accepted 5 March 1996.

Fig. 1. CT scan of the brain showing a 4 cm mass.

2 weeks of completing radiotherapy. MRI revealed an increase in size of the original lesion with tumor extending along the track for the stereotactic needle biopsy through the calvarium (Fig. 4). The tumor was resected, and pathology (Fig. 5) once again revealed PMRT which was histologically, immunohistochemically (Fig. 6), and ultrastructurally identical to the primary biopsy. The patient's condition continued to deteriorate and death occurred 6 months after the diagnosis.

DISCUSSION

PMRTs of the brain were first described in infants and young children. To our knowledge the oldest case reported was 21 years of age [4]. Our patient was 34 years old.

The immunohistochemical profile of primary renal rhabdoid tumors has been recently reviewed by Berry and Vujanic [6] who describe vimentin and low molecular weight cytokeratin as the most consistent immunohistochemical findings correlating with the cytoplasmic intermediate filament bundles seen ultrastructurally. The largest study to date of extrarenal tumors with "rhabdoid features" was performed on 42 cases by Parham and colleagues [7]. In this study, 12 of their 42 cases fulfilled their criteria for extrarenal rhabdoid tumors, the rest representing neoplasms of other phenotypes with rhabdoid features. Of these 12 tumors, 3 originated in the brain, 2 of which reacted against a variety of immunohistochemical reagents, including vimentin, cytokeratin, epithelial membrane antigen, neuron-specific enolase, S100 and muscle-specific actin. However, only the third so-called true central nervous system (CNS) rhabdoid tumors (case 13) revealed undifferentiated cells with cytoplasmic intermediate filament bundles similar to those in the present case. Immunohistochemical findings were not available for that case. In several recent case reports of primary CNS rhabdoid tumors [8–11], the cellular ultrastructure was characterized by cytoplasmic intermediate filament bundles with immunohistochemical findings confined to vimentin reactivity, identical to the present case. This pattern of ultrastructural cytoplasmic bundles of intermediate filaments reacting only with vimentin has proven to be useful in predicting the rhabdoid phenotype by fine needle aspiration in non-CNS sites [12].

The CNS location of these tumors is varied. PMRT

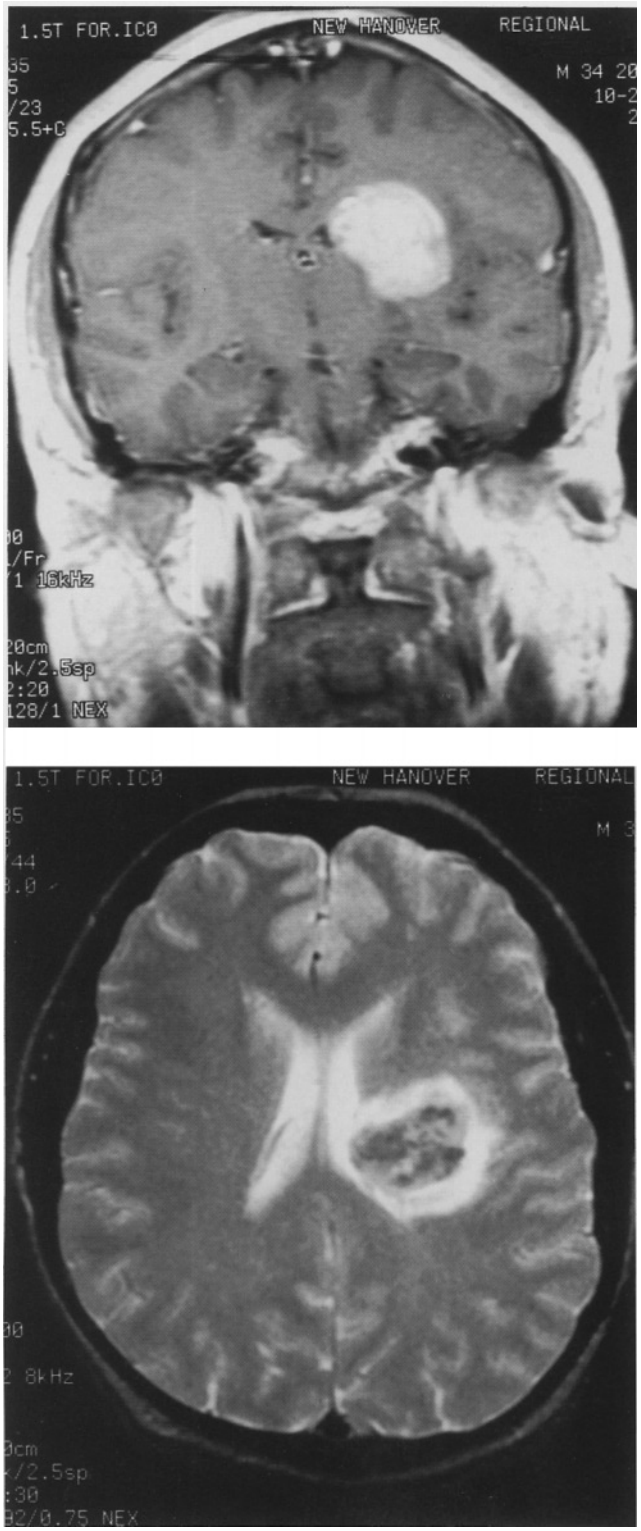


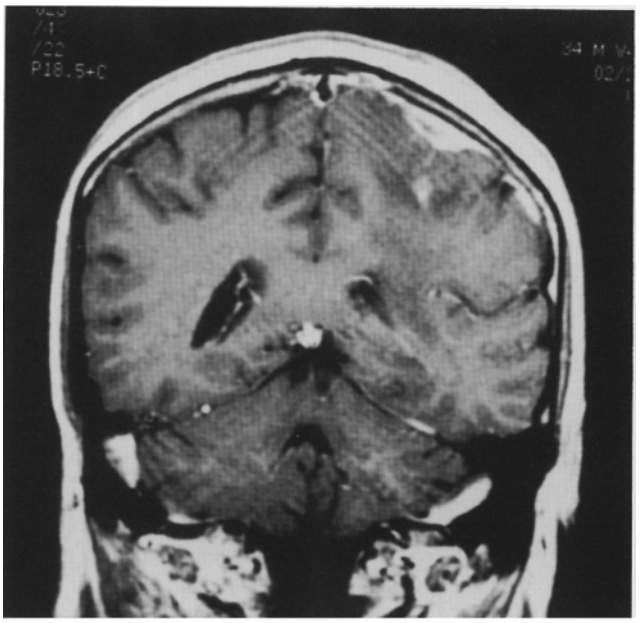
Fig. 2. MRI of the brain demonstrating the left cerebral mass.

Fig. 3. An electron micrograph shows a typical tumor cell with a large mass of whorled intermediate filaments displacing the nucleus to the periphery of the cell (formalin fixed, uranyl acetate and lead citrate stained) ×7,100.

has been reported in the cerebellum and parietal, frontal, and temporal lobes. All except one case were solitary lesions. Reported cases of PMRT demonstrate variability in X-ray attenuation coefficient, MR relaxation times, enhancement, calcification, and vasogenic edema. Our case demonstrated central hemorrhage, negligible vasogenic edema, and peripheral enhancement. PMRT is a rare brain neoplasm with varied imaging appearances which may occur in children and adults, thus making it imperative to rule out a renal origin of the tumor whenever it is diagnosed in an extrarenal site.

Implantation of the tumor cells along the needle track during a stereotactic biopsy is rare in brain tumors. It has been reported to occur in pineoblastoma and craniopharyngioma. To our knowledge, implantation metastasis of rhabdoid tumors has not been reported previously in this site. Implantation metastasis has been well documented to occur in various neoplasms, including those occurring in the lung [13], prostate [14,15], thyroid [16], pancreas [17,18], kidneys [19], and liver [18]. The incidence of implantation of tumor cells along the needle track is as low as 0.005% and 0.079% [20,21]. It is also influenced by the size of the needle used [13,22].

Experiments have been done to sheathe the needles while taking a biopsy which does not appear to reduce the incidence of implantation metastasis [22]. The capability of a tumor to grow by implantation depends upon the adhesiveness of the cells and the degree of malignancy [22]. Inoculum size is another determinant of this phe-



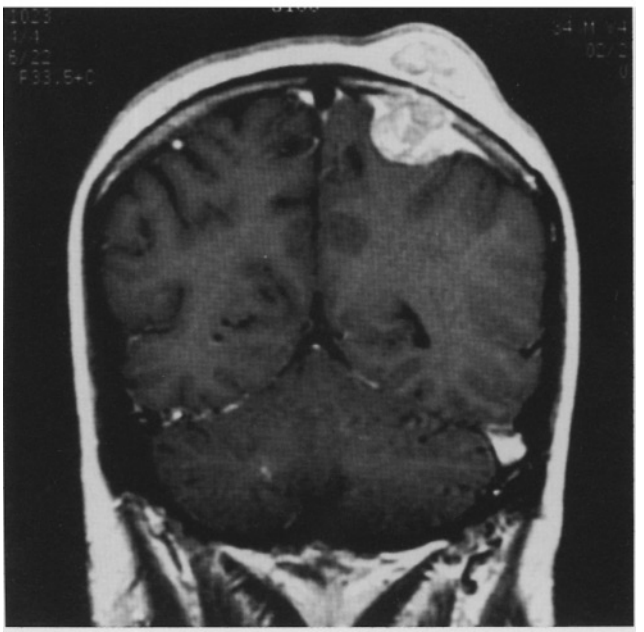


Fig. 4. MRI images of the brain showing the tumor growth at the site of needle biopsy. A faint track leading to the primary tumor is visible **(a)**.

nomenon. Greater than 10^6 cells were needed to cause tumor growth in subcutaneous tissues [23,24]. More knowledge of the mechanisms mediating metastasis and attachment of cells in PMRT is required before we can fully understand this phenomenon [25] and develop therapies with which to treat this highly malignant neoplasm.

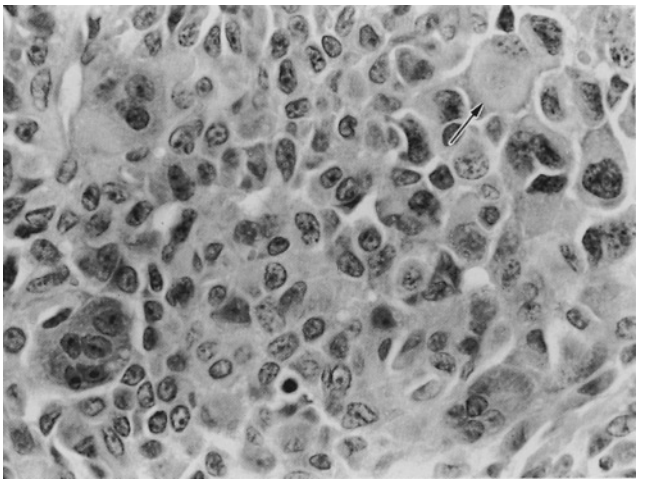


Fig. 5. The subcutaneous mass derived from the secondary resection reveals a tumor composed of polygonal cells with plentiful cytoplasm, prominent nucleoli, and occasional eosinophilic droplets (arrow). H&E, ×680.

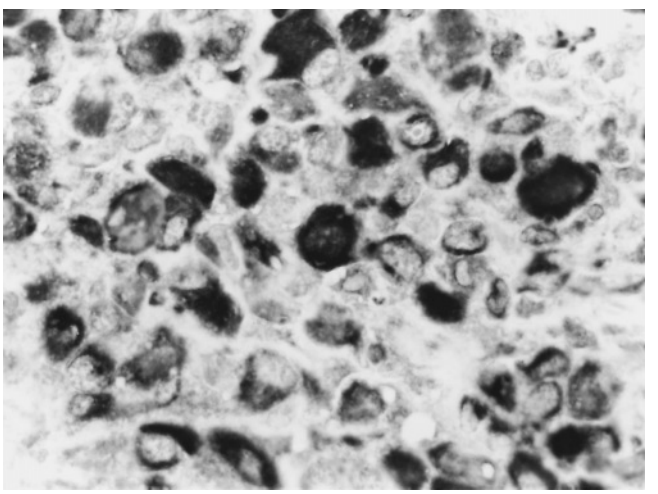


Fig. 6. Immunostaining for vimentin revealed the cytoplasmic inclusions to be strongly reactive. vimentin, ×680.

REFERENCES

1. Beckwith JB, Palmer NF: Histopathology and prognosis of Wilms tumor: Results from the First National Wilms' tumor study. Cancer 41:1937–1948, 1978.
2. Biggs PJ, Garen PD, Powers JM, Garvin AJ: Malignant rhabdoid tumor of the central nervous system. Hum Pathol 18:332–337, 1987.
3. Jakate SM, Marsden HB, Ingram L: Primary rhabdoid tumour of the brain. Virchows Arch [A] 412:393–397, 1988.
4. Horn M, Schlote W, Lerch KD, Steudel WI, Harms D, Thomas E: Malignant rhabdoid tumor: Primary intracranial manifestation in an adult. Acta Neuropathol (Berl) 83:445–448, 1992.
5. Hanna SL, Langston JW, Parham DW, Douglass EC: Primary malignant rhabdoid tumor of the brain: Clinical, imaging, and pathologic findings. AJNR 14:107–115, 1993.

6. Berry PJ, Vujanic: Malignant rhabdoid tumour. Histopathology 20:189–193, 1992.
7. Parham DM, Weeks DA, Beckwith JB: The clinicopathologic spectrum of putative extrarenal rhabdoid tumors. An analysis of 42 cases studied with immunohistochemistry or electron microscopy. Am J Surg Pathol 18:1010–1029, 1994.
8. Rosemberg S, Menezes Y, Sousa MR, Plese P, Ciquini O: Primary malignant rhabdoid tumor of the spinal dura. Clin Neuropathol 13:221–224, 1994.
9. Caldemeyer KS, Smith RR, Azzarelli B, Boaz JC: Primary central nervous system malignant rhabdoid tumor: CT and MR appearance simulates a primitive neuroectodermal tumor. Pediatr Neurosurg 21:232–236, 1994.
10. Muller M, Hubbard SL, Provias J, Greenberg M, Becker LE, Rutka JT: Malignant rhabdoid tumour of the pineal region. Can J Neurol Sci 21:273–277, 1994.
11. Manhoff DT, Rorke LB, Yachnis AT: Primary intracranial atypical teratoid/rhabdoid tumor in a child with Canavan disease. Pediatr Neurosurg 22:214–222, 1995.
12. Akhtar M, Kfoury H, Haider A, Sackey K, Ali MA: Fine-needle aspiration biopsy diagnosis of extrarenal malignant rhabdoid tumor. Diagn Cytopathol 11:271–276, 1994.
13. Sacchini V, Galimberti V, Marchini S, Luini A: Percutaneous transthoracic needle aspiration biopsy: A case report of implantation metastasis. Eur J Surg Oncol 15:179–183, 1989.
14. Greenstein A, Merimsky E, Baratz M, Braf Z: Late appearance of perineal implantation of prostatic carcinoma after perineal needle biopsy. Urology 33:59–60, 1989.
15. Haddad FS, Somsin AA: Seeding and perineal implantation of prostatic cancer in the track of the biopsy needle. Three case reports and a review of the literature. J Surg Oncol 35:184–191, 1987.
16. Engzell U, Esposito PL, Rubio C, et al.: Investigation on tumour spread in connection with aspiration biopsy. Acta Radiol (Ther) 10:385–398, 1971.
17. Ferrucci JT Jr, Wittenberg J, Margolies MN, Carey RW: Malignant seeding of the tract after thin-needle aspiration biopsy. Radiology 130:345–346, 1979.
18. Onodera H, Oikawa M, Abe M, Chida N, Kimura S, Satake K, Motojima T, Goto Y: Cutaneous seeding of hepatocellular carcinoma after fine-needle aspiration biopsy. J Ultrasound Med 6:273–275, 1987.
19. Kiser CG, Totonchy M, Barry JM: Needle tract seeding after percutaneous renal adenocarcinoma aspiration. J Urol 136:1292–1293, 1986.
20. Smith EH: The hazards of fine-needle aspiration biopsy. Ultrasound Med Biol 10:629–634, 1984.
21. Sinner WN, Zajicek J: Implantation metastasis after percutaneous transthoracic needle aspiration biopsy. Acta Radiol (Diagn) 17:473–480, 1976.
22. Glasgow BJ, Brown HH, Zargoza AM, Foos RY: Quantitation of tumor seeding from fine needle aspiration of ocular melanomas. Am J Ophthalmol 105:538–546, 1988.
23. Southam CM, Brunschwig A: Quantitative studies of autotransplantation of human cancer. Preliminary report. Cancer 14:971–978, 1961.
24. Vaitkevicius VK, Sugimoto M, Reed ML, et al.: Autologous transplantation of enzymically prepared and fresh preserved human tumors. Cancer 17:666–673, 1964.
25. Muller M, Hubbard SL, Fukuyama K, Dirks P, Matsuzawa K, Rutka JT: Characterization of a pineal region malignant rhabdoid tumor: Towards understanding brain tumor cell invasion. Pediatr Neurosurg 22:204–209, 1995.